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## ABSTRACT

The current study aimed to pilot a methodology for measuring implicit communication processes in novice and expert teams. To achieve this, implicit communication in expert teams (civilian and military) was compared with novice teams performing the same task. Analysis showed that expert teams, or those that have worked together previously, use more implicit communication strategies to achieve team goals than novice teams, regardless of their area of expertise (military, sporting or business teams). This suggests that expert teams may be utilising shared mental models of both the roles of their teammates and how they should be working together in a group situation. The researchers conclude that the training of military teams in the roles and responsibilities of their teammates is an important issue for the Australian Defence Force. This is particularly the case where teams are physically distributed across the battlespace.

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# Implicit Communication in Novice and Expert Teams

## Executive Summary

An increase in the adaptation and development of information technologies has led to the ability to spatially and temporally separate teams across large distances. This is valuable to the Australian Defence Force as it enables the dispersion of teams, such as Brigade Headquarters, across a wide geographical range. This has the advantage of decreasing their ecological footprint while maintaining situational awareness. At the same time it is important to ensure new technologies do not disrupt the team's ability to generate and employ a shared mental model. In dynamic environments, such as the battlespace, shared mental models of situations enable teams to adapt by allowing members to predict their teammates' needs. Intra-team communication is thought to contribute to the development of shared mental models by cultivating knowledge of each teammate's function, and what information they need to perform their tasks. In times of high stress, such as in novel situations, research has shown that teams are more likely to use implicit communication strategies (such as volunteering helpful information or making suggestions), aided by shared mental models. This is thought to reduce communication and coordination overhead.

Previous research into novel environments has focused on quality of communication rather than type (implicit/explicit), and the teams often have a lifespan of only a few hours. The current pilot study focused on the use of implicit communication strategies in novice and expert teams in novel environments. Participating teams had a lifespan of 6 months to four years for the expert sample, and the novices had never previously worked together. Implicit communication strategies were assessed via behavioural measures and a self-report questionnaire.

Results demonstrated that the expert teams used more implicit communication strategies than those who had never worked together before (eg. volunteering information to their teammates). This result occurred when comparing novice team scores with both military and civilian (sporting and business) expert teams. In addition, gender was seen to have an impact on implicit communication strategies, where single-sex teams showed more observable implicit behaviours than mixed sex teams.

Based on these findings, a number of areas for future research were identified. These included:

1. Examining the relationship between implicit communication and performance.
2. Examining the effects of familiar and unfamiliar environments on implicit communication strategies in relation to routine and non-routine tasks.
3. Establishing the effect of extraneous variables such as gender and personality on the use of implicit communication within teams.

It was also concluded that the development of team-based shared mental models via cross training needs to be a focus of military team development. This is especially relevant in an age where fellow team members may not be in the same room, state, or even country as each other.

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# Contents

# 1. Introduction

## 1.1 The Importance of Teams

Teams are an integral part of today's culture, appearing everywhere from our recreational activities to our workplaces. They provide social stimulation for members, have been credited with increasing productivity and flexibility in organisations, decreasing production costs, and reducing levels of conflict (Stewart, Manz, & Sims Jr., 1999). Consequently there is a need for research on factors that predict effective team performance. Recent literature has suggested that member co-ordination is an integral part of team performance (Brannick & Prince, 1997). Annett, Cunningham, and Mathias-Jones (2000) argued that when defining teams, "the core definition must involve the principle that the team members combine their efforts to achieve a common goal" (p.1077). This suggests that the ability of teams to synchronise their actions effectively is an important part of teamwork.

## 1.2 Coordination and Communication

Coordination in a team environment can be either explicit or implicit. With explicit coordination, information in response to requests and direct communication are used to coordinate actions. Implicit coordination is when the information needs of others are anticipated through a common mental image of the event between members (Serfaty, Entin and Deckert, 1994). This common mental image is known as a shared mental model, where the team has "some awareness of how the situation in the area looks and .... a hypothesis about how it might evolve" (Artman, 1999, p. 1405). In other words teammates share a common knowledge of the events taking place around them. In this way shared mental models enable teams to adapt to new and dynamic environments by allowing them to predict the needs of their teammates, thus coordinating their actions. A study by Volpe, Cannon-Bowers, Salas, and Spector (1996) for example, looked at the effects of cross-training on task performance in two-person team F-16 flight simulations. In cross-training, individuals are trained on the tasks of other members, as well as their own. It was found that cross-trained teams performed significantly better than their single role counterparts on multiple measures (such as the number of enemy aircraft destroyed and the time it took to shoot down the first target). The finding that team-shared mental models have a positive effect on performance has since been supported by other researchers in both military style tasks (Cannon-Bowers, Salas, Blickensderfer, & Bowers, 1998; Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000) and in civilian disaster management (Smith & Dowell, 2000).

In an attempt to understand how shared mental models develop, the ways in which teams communicate has been the focus of recent research. According to Schraagen and Rasker (2001) communication, especially in novel situations, is used to maintain a current shared mental model that aids teams in altering strategies or planning new ones. A recent study by Rasker, Post and Schraagen (2000) examined the effects of intra-team feedback on the

development of shared mental models in student teams. It was found that teams that were able to engage in unrestricted communication during, between, and after tasks, performed significantly better than those who could not. Teams in the unrestricted conditions also engaged mainly in activity-based communication or that involving progress and feedback on problems. By providing each other with feedback, team members are developing a shared mental model of the situation and can then alter their strategies more effectively to decrease errors.

As with coordination, communication within teams can come in two forms, either implicit or explicit. Implicit communication involves voluntarily offering other team members any necessary information, whereas explicit communication involves offering information in response to a specific request (Rasker et al., 2000). In times of high stress, as in a novel situation, teams are more likely to perform using implicit communication conditions aided by shared mental models, allowing them to reduce communication and coordination overhead (Entin & Serfaty, 1999; Schraagen & Rasker, 2001; Stout, Cannon-Bowers, Salas, & Milanovich, 1999). For example, Serfaty, Entin and Deckert (1994) examined team performance in naval personnel on a computer-based military exercise under varied conditions of uncertainty, time pressure and ambiguity. It was found that in high stress conditions (high uncertainty, time pressure and ambiguity), lower error rates occurred. In addition, there was a shift to implicit strategies where communication was reduced and redirected, along with an alteration in the context of messages. Other researchers have supported the concept that implicit communication is increased in teams with an integrated shared mental model (Cannon-Bowers et al; 1998; Volpe et al; 1996; and Entin & Serfaty, 1999). These studies suggest that one avenue for teams to function effectively is via more economical communication techniques.

## 1.3 The Application of Communication: Expert Teams in Novel Situations

Military teams often have brief performance events, which require training and expertise to ensure closely synchronised actions. Merriam-Webster (2002) defines expertise as having, involving, or displaying special skill or knowledge derived from training or experience. Although an important part of military functioning, the communication processes of experts when compared to those of novices have been relatively under researched. Kanki and Foushee (1989), in their study on the communication patterns of air transport pilots, found that crews that had recently flown together made fewer errors in a simulated flying task than those who had not. This result was achieved even though "the flown together" (FT) pilots had just come off a shift and were significantly more fatigued than the "not flown together" (NFT) teams who had recently been on a break. The FT teams also produced more statements of intent (a possible indicator of implicit communication) than the NFT teams who spent more time on non-task related communications. These results suggest a possible relationship between implicit communication processes and team composition, for example those with expert and novice members.

As well as their expertise, another defining element of a military team is their ability to perform in novel environments. According to Marks (1999), novel environments have "unfamiliar elements, so they are less familiar (and less predictable) to team members, more challenging, and may require changes in performance strategies to successfully accomplish the mission" (p. 297). Recent team research by Marks, Zaccaro and Mathieu (2000) has shown that team communication is an important characteristic of superior performance in dynamic situations. In their study of 237 undergraduates, trained as three member tank platoons, it was found that an increase in communication quality (as judged by subject matter experts (SMEs) observing interactions) not only led to an increase in team performance in a novel situations but this increase was significantly higher than that of the routine environment. This demonstrates that teams rely heavily on effective communication to overcome the problems associated with operating in a novel environment.

### 1.4 Aims and Hypothesis

Whilst research on implicit team communication and performance has been performed, the applicability of its results to a military setting is limited. Not only have current studies on performance in novel environments focused on quantity or quality of communication rather than type (implicit/explicit), their choice of sample teams is largely limited to either undergraduates with a team lifespan of a few hours, or expert teams with a high amount of training, and no comparison between the two.

The primary aim of the current research, is to pilot a method of measuring the implicit team processes that affect command and control ($C^2$) performance in both expert and novice, as well as military and civilian teams. This will provide insight into possible team-related effects of the introduction of new technologies, particularly the impact of shared mental models on training and systems design.

From this the following hypothesis was developed: expert teams overall will demonstrate a higher level of implicit communication processes than novice teams, when performing a novel task.

In addition there will be an examination of the effects of any extraneous variables on the implicit communication strategies of teams.

## 2. Method

### 2.1 Participants

Thirty-six volunteers participated in the study. They included civilian novices, civilian experts and military experts. For the purposes of this study 'expert' teams are defined as

teams whose members have worked together as a team both extensively and recently (that is in the past two months). 'Novice' teams are those whose members have never worked together previously as a team.

The civilian novices consisted of six three-person teams of DSTO employees. A lack of previous team experience together was aided by choosing members from different divisions around the DSTO site. The average age of the sample was 35 (standard deviation (S.D.) = 10.62) and 55% of the team members were female.

The civilian expert sample consisted of three teams of volunteers. Two of the teams had played together in a sporting club for a period ranging from six months to 4 years, and the third team were DSTO employees who had recently returned from working on a trial together. The average age of this sample was 30 (S.D. = 11.97), and 44% of members were female.

The three teams of military subjects were part of the 16th Air Defence Regiment located at Woodside Army Barracks. All members had worked together on previous occasions. Their average age was 28 (S.D. = 6.79) and all of the participants were males.

## 2.2 Materials

The novel task was a team building exercise taken from Orridge (1996). Participants were asked to build a paper bridge, with 20 minutes planning time and 10 minutes for construction (for a full list of instructions and materials see Appendix A).

Implicit communication was recorded using an observational measure and a self-report questionnaire. The observational measure, adapted from Brehmer and Svenmarck (1995), involved encoding all of the participant's verbal communications in accordance with 6 main categories. Specific rules regarding what type of communication was to be included in each category were determined before observations. These included

- Requests for Information: Task, which were questions related to the bridge itself.
- Questions: Other, were any other questions unrelated to the bridge building task.
- Information: Answers to Questions, included acknowledgements (for closed questions) and any responses to specific questions asked by other teammates.
- Information: Voluntary, involved information relating to the task, including suggestions, that were not answers to questions.
- Commands were incidents of the participants telling each other to do something, not including suggestions.
- Acknowledgements were unrelated to answers to questions. Examples of material that may fall under these categories can be found in Appendix B.

Questionnaires were scored by calculating the anticipation ratio (AR). This is the overall incidence of voluntary information transfers (for example the number of information transfers in the categories of 'information: answers to questions' and 'information: voluntary') divided by the number of requests for information ('Requests for information:

task' and 'questions: other'). Observed examples of language, context and communication patterns for each of the categories were also recorded during the task.

The self-report questionnaire used, referred to as the Implicit Communication Questionnaire (ICQ), was modified from Hallam and Campbell's (1997) Team Development Survey. It consisted of 10 items where respondents were asked to acknowledge their agreement with each statement based on a 5-point Likert scale. For example;

My team members are skilled and competent

| Strongly Agree | Agree | | Disagree | Strongly Disagree |
|---|---|---|---|---|
| O | O | O | O | O |

Items 2, 3, 5, and 10 were scored positively (1 (strongly agree) to 5 (strongly disagree)), whereas item 7 was scored negatively. Scoring of items 1, 4, 6, 8, and 9 was not included as they were random team performance questions (All items can be seen in Appendix C). Relevant demographic data included age, gender and education.

## 2.3 Procedure

Participants were recruited either by direct contact with the researcher, advertisements placed on noticeboards, or via e-mail. Data collection for the civilian novices occurred in a conference room on DSTO grounds. Participants were arranged around one end of a table with the building materials placed in between them. A video camera and tripod were assembled at the opposite end of the room to record their actions. The volunteers and the researcher were the only people in the room at the time of the experiment. For the civilian experts, data collection occurred at either the site of their current game or at DSTO. Game sites ranged from an oval outside a sporting complex to a squash court inside a school building. Military participant data was collected on-site at Woodside Army Barracks. Participants were arranged in relatively the same position as the novices on the floor or at a desk, and the researcher and participants were the only people in the immediate area. Observational measures based on a review of the video footage for the civilian novice teams demonstrated an intra-rater reliability of .93, as such filming of the civilian expert and military teams was considered unnecessary.

Each team member initially read a participant information sheet (See Appendix D), signed a consent form (Appendix E) and read a written description of the bridge building task (Appendix F). The researcher also gave brief additional verbal instructions. After the bridge was completed, the researcher answered any additional questions the participants had, and questionnaires were distributed and filled out by the team members.

# 3. Results

Considering the small sample sizes, non-parametric tests were deemed most appropriate. Mann-Whitney U independent samples tests were used to examine mean differences between groups.

## 3.1 Hypothesis

Analysis of the data on implicit communication in expert (that is combined military and civilian expert teams) and novice civilian teams demonstrated that experts were significantly more implicit in their communication behaviours than novices ($z = -2.89, p < .05$) on the self-report measure. In addition, observer based rates of implicit communication showed experts as being significantly more implicit ($z = -2.09, p = < .05$) than civilian novices ($M = 2.72$, S.D. = .42). Figures 1 and 2 demonstrate these results.

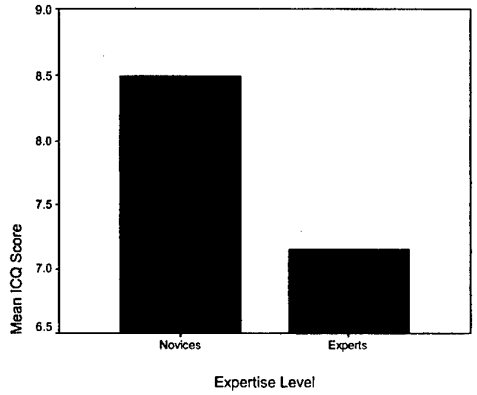


*Figure 1: Mean difference between experts and novices in ICQ scores*

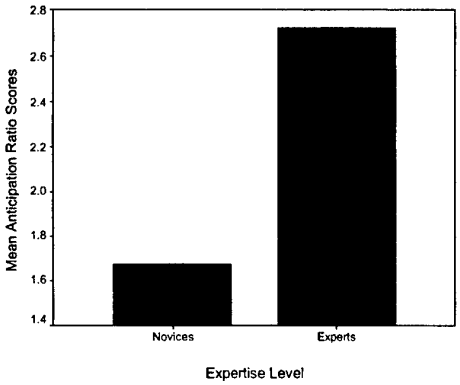


*Figure 2: Mean differences between experts and novices in anticipation ratios*

Figure 1 shows that experts scored significantly lower on the self-report ICQ ($M = 7.15$, S.D. = .90) than civilian novices ($M = 8.49$, S.D. = 1.18. Figure 2 demonstrates that civilian experts have significantly higher anticipation ratios ($M = 2.72$, S.D. = .42) than civilian novices ($M = 1.67$, S.D. = .12). Both of these findings suggest that regardless of the data collection method (self-report or observation) teams that have worked together previously make more suggestions, and volunteer more information than teams who have never worked together before, thus supporting the hypothesis that expert teams will demonstrate a higher level of implicit communication processes than novice teams while performing a novel task.

Additional analysis of the data showed that there was no significant difference between the two types of expert teams (civilian and military) on either the self-report or observational measures of communication ($z = -.664$, $p > .05$ and $z = -.443$, $p > .05$

respectively). This demonstrates that implicit communication is a factor of team experience, not necessarily a function of domain expertise.

### 3.2 Additional Findings

An independent samples analysis of the role of gender in implicit communication strategies showed a significant relationship between the gender of the team involved (all-female, all-male or mixed) and their anticipation ratio scores ($z = -2.84$, $p < .05$). These results are shown in Figure 3.

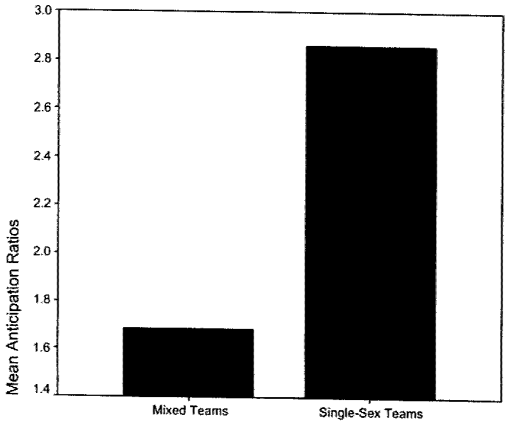


*Figure 3. Mean Anticipation Ratio Differences Between Teams of Different Gender*

These results indicate that teams consisting of all males or all females demonstrate more implicit communication strategies (M= 2.86, S.D.= 0.29) than mixed gender teams (M= 1.73, S.D.= 0.18). Therefore, gender is an important factor in the use of implicit communication in teams.

## 4. Discussion

### 4.1 Overview

Teams are becoming increasingly important in today's society, with efficient teamwork forming the backbone of many contemporary organisations. The ability to coordinate actions towards a common goal is at the core of what it means to be a team (Brannick & Prince, 1997 ; Woodcock, 1979). This synchronicity of actions stems from common knowledge, that is the knowledge generated through experience of people engaged in a set task (Dixon, 2000). Also known as a shared mental model, team-based knowledge of the roles and responsibilities of other members allows team members to predict their teammates needs, enabling them to volunteer information that they believe is necessary at

the correct time (Rasker et al., 2000). In high stress and novel situations, the ability for teams to reduce communication overhead through a switch to more implicit communication strategies is vital for efficient team performance.

The aim of this pilot research was to examine these implicit team strategies used in expert and novice teams, in an effort to delineate the effects of novel environments, and the introduction of new technology on military teams. All of the findings and their implications will be discussed in terms of the hypothesis and additional findings.

## 4.2 Hypothesis

The current research supported the hypothesis that expert teams used more implicit communication strategies than those who had never worked together before. This is consistent with previous research by Kanki and Foushee (1989), who found that two-man teams that had recently flown together produced more statements of intent than those who had not recently flown together. Statements of intent (defined as "announcement of an intended action", p.405), can be considered examples of implicit communication, as they involve offering voluntary information that may be needed by other team members. Although Kanki and Foushee (1989) used participants who could all be considered experts (all were experienced pilots) the fact that those that had recently flown together used more implicit communication strategies than those who had not still draws relevant parallels to the current paper. In addition this finding has been extended, demonstrating that this phenomenon is applicable not just to a small subset of expert teams but across a wide variety, including military, sporting and business teams.

Kanki and Foushee (1989) suggest that the differences in communication styles between flown together and non-flown together teams emerge because "crews who have not previously flown together, may not have had the opportunity to familiarize themselves ... with each other's habits, styles, etc." (p.409). This is indicative of information that would be part of a teams' shared mental model, which is the understanding between team members of who is responsible for what task and what their information requirements are (Stout et al., 1999). As discussed, the knowledge of a teammate's function and how they perform their tasks enables one to predict the information needs of fellow members, thus co-ordinating team action. In relation to the current study, expert teams, who had worked together for periods ranging from 6 months to four years, have more knowledge of the habits, roles and functions of their teammates than those who had never worked together. Because of this, in a novel situation (which is often associated with increased stress) they were more likely to switch to implicit communication patterns, thereby reducing communication overhead. Thus shared mental models enabled the expert teams to adapt more efficiently to a new and dynamic environment.

This finding has important implications in a $C^2$ setting. For example, research by Rasker et al., 2000 ; Volpe et al., 1996; and Hutchins, Hocevar, & Kemple, 1999, has shown that changes in communication patterns amongst teams are often associated with an increase in their performance. The notion that implicit communication is linked to increased team

performance, coupled with the suggestion that expert teams are significantly more implicit than novice teams, highlights the need for efficient and effective team building and training exercises in $C^2$. An example is suggested by Cannon-Bowers et al. (1998), where cross-training, or training team members in the roles of their teammates, may increase interpositional knowledge and allow teams to communicate more implicitly. Therefore, further attention to the development and maintenance of shared mental models in $C^2$ teams should prove useful to the Australian Defence Force.

## 4.3 The Impact of Gender on Implicit Communication

In terms of extraneous variables, the current research has pointed to the gender of team members as having an effect on implicit communication strategies. Specifically, homogeneous or unisex teams used more implicit communication than heterogeneous teams. This finding is not consistent with previous research. Meta-analytic studies, such as Bowers, Pharmer and Salas (2000), have shown that teams that are heterogeneous in terms of their gender, personality and ability level perform better (although effect sizes were not significant) than homogeneous groups. This is important as previous research shows that increases in implicit communication strategies coincide with increases in performance. Therefore mixed gender teams should show drops in performance when compared to unisex teams. An explanation for this can be found within the limitations of the current study design. For example the civilian novice teams only had mixed gender participants. That is there were no all female or all male novice teams. Because novices were predicted to show less implicit communication than expert teams, these teams appeared less implicit. Nonetheless, these findings suggest that gender has an important, yet unexplored, impact on implicit communication in teams.

## 4.4 Limitations and Future Research

The limitations in the current research generally involved the methodology, and each had an impact on future research. As such, these issues will be discussed broadly in terms of three main areas.

### 4.4.1 Measures of Implicit Communication

The measures used in the current study were based on pre-existing measures of team performance and development. While this led to a certain amount of surface validity, the survey and observational measures contained no established internal validity. However, this was deemed acceptable due to the preliminary nature of the work, and the existing validity that comes from using base tests that are already established. Given the strong results from the measures, future validation of these tests in a wider setting would be a valuable avenue of research.

### 4.4.2 Tasking

Communication strategies have been shown to differ during the performance of novel tasks when compared to familiar tasks (Marks et al., 2000). Due to both time constraints and a lack of clearly defined expert tasks, the task used in the study was restricted to a novel condition. That is a task which none of the teams had performed before. In addition, previous research has suggested that in situations where an increase in implicit communication occurs team performance is also elevated (Rasker et al., 2000). The nature of the current task however did not allow for a measure of team performance to be taken and as such no evidence could be added to this body of knowledge. Future research into implicit communication then, must focus on defining both the impact of the environment on team performance as well as its relationship to implicit communication.

### 4.4.3 Participant Gender

As was mentioned previously, the gender mix of the team members was not evenly distributed between the novice and expert teams. All of the novice teams, who were predicted to use fewer implicit communication strategies, were of mixed gender. Because previous research does demonstrate a link between team gender and team processes (Bowers *et al*, 2000), the possibility exists that this limitation influenced some of the gender related findings of the current research. Therefore, the links between gender and implicit communication within teams is another important area of further development. More specifically, it would be valuable for research on the relationship between gender, expertise level and communication strategies.

## 4.5 Summary and Conclusion

In summary, current research suggests that teams who have experience working together are more likely to use implicit communication strategies in novel situations than teams who have never worked together previously. Coupled with research to suggest that increased implicit communication may be linked to both increases in performance and the development of shared mental models, the development of team-based common knowledge via cross-training may be an avenue for military team development. This is especially relevant in an age where fellow team members may not be in the same room, state, or even country as each other.

In addition a number of areas for future research were identified. These include:

1. Further examination of the effects of familiar and unfamiliar environments on implicit communication strategies in relation to routine and non-routine tasks.
2. Establishing the effect of extraneous variables such as gender on the use of implicit communication within teams.

# 5. Acknowledgments

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http://www.m-w.com/

# Appendix A: Bridge Building Task Instructions

-This exercise has teamwork, communication, and strategy development components.

- Need:
A series of weights- 100g
Paper or newspaper (Two 120 page newspapers/team)
Cardboard (Two sheets/team)
Paper clips
A stapler and staples
Adhesive tape
Ruler

-Takes approximately 30-35 minutes

- Procedure:
Explain that each team has 20 minutes to design a bridge followed by 10 minutes to construct it. It must be able to span 0.5 metres. Participants cannot stick the bridge to the table or use the solid objects (such as the ruler, stapler and scissors) as part of the actual construction materials.
The winning team will be that with the highest score. This is calculated as the load the bridge can take without collapsing, divided by the time taken to build the bridge. The load is measured in grams, and the time will be measured in seconds.
Give each team a set of materials and begin the design phase.
Issue with fresh supplies and begin the construction phase.
Using 200g intervals place weights on top of each other until the bridge collapses.

# Appendix B: Implicit Behaviour Category Definitions

- Requests for Information: Task

-Have to be related to the bridge itself. Can include strategy but not suggestions.
-E.g. Do we have enough paperclips?, Is this wide enough?, How about if we do it like....? etc

- Questions: Other

-Are unrelated to the bridge.
-E.g. What's this for?. How much time do we have?

- Information: Answers to questions

-Including acknowledgements (for closed questions)

- Information: Voluntary

-Relating to the task, including suggestions, that are not related to answers to questions
-E.g. If we do it this way...., I think it would be better if...., We only have a few minutes left, I've prepared the paperclips etc

- Commands

-Telling somebody to do something, not including suggestions
-E.g. Put that on there, Do .....now etc

- Acknowledgements

-Are unrelated to answers to questions
-E.g. If we do it this way....Mmmhmm, Do..... O.K. etc.

# Appendix C: Implicit Communication Questionnaire


Age: _____
Gender:_____
Education (years):_____

Instructions: Please tick your responses according to your agreement with the following questions:

1. My team members are skilled and competent

| Strongly Agree | Agree | | Disagree | Strongly Disagree |
|---|---|---|---|---|
| O | O | O | O | O |

2. I understood what was expected of me from my team members during this task without being told

| Strongly Agree | Agree | | Disagree | Strongly Disagree |
|---|---|---|---|---|
| O | O | O | O | O |

3. My team members anticipated what I needed from them during the task

| Strongly Agree | Agree | | Disagree | Strongly Disagree |
|---|---|---|---|---|
| O | O | O | O | O |

4. We rarely stop to discuss how we can work better as a team

| Strongly Agree | Agree | | Disagree | Strongly Disagree |
|---|---|---|---|---|
| O | O | O | O | O |

5. My team members volunteered helpful information

| Strongly Agree | Agree | | Disagree | Strongly Disagree |
|---|---|---|---|---|
| O | O | O | O | O |

6. This team suffers from a lack of training and experience

| Strongly Agree | Agree | | Disagree | Strongly Disagree |
|---|---|---|---|---|
| O | O | O | O | O |

7. I often did not know what I was supposed to be doing on this team

| Strongly Agree | Agree | | Disagree | Strongly Disagree |
|---|---|---|---|---|
| O | O | O | O | O |

8. We discussed our action plans frequently during the task

| Strongly Agree | Agree | | Disagree | Strongly Disagree |
|---|---|---|---|---|
| O | O | O | O | O |

9. So far our team has been a great success

| Strongly Agree | Agree | | Disagree | Strongly Disagree |
|---|---|---|---|---|
| O | O | O | O | O |

10. I often offered information to other members without being asked

| Strongly Agree | Agree | | Disagree | Strongly Disagree |
|---|---|---|---|---|
| O | O | O | O | O |

# Appendix D: Participant Information Sheet


Dear Participant,

My name is Kelly Swain and I am a vacation student at the Defence Science and Technology Organisation (DSTO). As part of my employment I am undertaking a research project looking at the role of communication in teamwork. Although much research in this field has focused on team communication in a familiar or rehearsed environments, little has been done on their performance in novel situations.

As part of this project you will be asked to complete a team-building exercise with two other people. Your participation will be recorded on both videotape and audiotape for further analysis. After the task you will be asked to fill in a short questionnaire o your attitudes towards the team. All responses will be anonymous and any audio/visual material collected will be seen only by the project researchers. The whole process should take approximately 40 minutes- 1 hour.

Your participation is greatly appreciated. If you have any further questions regarding this project, feel free to contact my supervisors, Dr Vanessa Mills (8259 7914) and Dr Monique Kardos (8259 7124) or myself (8259 7310).

Your Sincerely

Kelly Swain

# Appendix E: Participant Consent Form


1. I, _____ (Please print name) hereby give my consent to participate in the research project entitled:

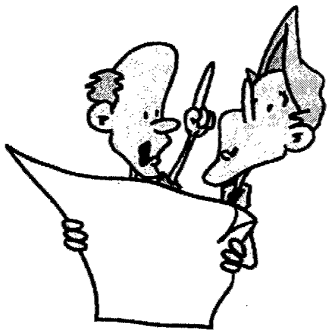
   The Role of Communication in Teamwork

2. I acknowledge that I have read the information sheet entitled 'participant information' and I understand what is being asked of me.
3. I have been informed that the information I provide will be kept confidential.
4. I understand that I am free to withdraw from the project at any time.
5. I am aware that I should retain a copy of this consent form, when completed, and the attached information sheet.
6. I am aware that should I have any questions regarding my participation in this project I may contact the research investigators on the contact details in the information sheet.

_____ _____

(Please sign name) (Date)

# Appendix F: Participant Task Instructions



## Strong Bridge

Your task, should you choose to accept it, is to design and build a bridge.

You will have 20 minutes planning time at the start of the exercise. Feel free to use the building materials if needed as fresh ones can be supplied later. After that you will have 10 minutes to build your bridge (Please do not begin building until I have given you the all clear as your performance is timed).

The bridge itself must be able to span at least 0.5 m and you may use any of the materials given.

The winning team will be judged on both the amount of weight the bridge is able to hold as well as the amount of time it takes to build it.

Good luck!

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Kelly Swain & Vanessa Mills

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19. ABSTRACT

The current study aimed to pilot a methodology for measuring implicit communication processes in novice and expert teams. To achieve this, implicit communication in expert teams (civilian and military) was compared with novice teams performing the same task. Analysis showed that expert teams, or those that have worked together previously, use more implicit communication strategies to achieve team goals than novice teams, regardless of their area of expertise (military, sporting or business teams). This suggests that expert teams may be utilising shared mental models of both the roles of their teammates and how they should be working together in a group situation. The researchers conclude that the training of military teams in the roles and responsibilities of their teammates is an important issue for the Australian Defence Force. This is particularly the case where teams are physically distributed across the battlespace.